

THINNING AND CARBON—SCIENCE SUGGESTS CARBON LOSSES

Hudiburget al. 2013 and 2009; Law & Harmon 2011; Mitchell et al. 2009, Meigset al. 2009; Campbell et al. 2011)

Amount of biomass combusted in high-severity crown fire is greater than low-severity surface fire, but difference is small.

Low likelihood treated forests will be exposed to fire while effective (~20 yrs)

Thinning larger area to decrease probability of high-severity fire *ensures* decreased carbon stock and net carbon balance over treated area.

Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management 2011

“Thinning forests to reduce potential carbon losses due to wildfire is in direct conflict with carbon sequestration goals, and, if implemented, would result in a net emission of CO₂ to the atmosphere because the amount of carbon removed to change fire behavior is often far larger than that saved by changing fire behavior, and more area has to be harvested than will ultimately burn over the period of effectiveness of the thinning treatment.”

Accounting for Climate-Related Risks In Federal Forest-Management Decision

The value of carbon storage in uncut forests “Outweigh the additional timber-related benefits by more than 30-to-1. The value of this carbon storage is equal \$1.6 million per additional timber-related job.

Chiono, Lindsay 2011. Balancing the Carbon Costs and Benefits of Fuels Management. Research Synthesis for Resource Managers. Joint Fire Science Program Knowledge

“The net carbon impact of fuel treatments is further complicated by the probabilistic nature of wildfire occurrence and the impermanence of post-treatment stand conditions ... Treatment activities produce an immediate carbon emission while future wildfire emissions are uncertain ... “

Carbon implications of current and future effects of drought, fire and management on Pacific Northwest forests q
B.E. Law ↑, R.H. Waring

“By accounting for more of the benefits and costs involved in reducing the risk of crown fires, modifying storage in long- and short-term products, and in substituting wood products for fossil fuel (biomass), we find that thinning existing forests to reduce crown-fire risk increases net carbon emissions to the atmosphere for many decades... “

Mitchell, Harmon, O'Connell. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. *Ecological Applications*. 19(3), 2009, pp. 643–

“Reducing the fraction by which C is lost in a wildfire requires the removal of a much greater amount of C, since most of the C stored in forest biomass (stem wood, branches, coarse woody debris) remains unconsumed even by high-severity wildfires. For this reason, all of the fuel reduction treatments simulated for the west Cascades and Coast Range ecosystems as well as most of the treatments simulated for the east Cascades resulted in a reduced mean stand C storage.”

John L Campbell, Mark E Harmon, and Stephen R Mitchell. 2011. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? *Front Ecol Environ* 2011

“Results suggest that the protection of one unit of C from wildfire combustion comes at the cost of removing three units of C in fuel treatments.”

Reinhardt, Elizabeth, and Lisa Holsinger 2010. Effects of fuel treatments on carbon-disturbance relationships in forests of the northern Rocky Mountains. *Forest Ecology and Management* 259 (2010) 1427–

“Although wildfire emissions were reduced by fuel treatment, the fuel treatments themselves produced [carbon] emissions, and the untreated stands stored more carbon than the treated stands even after wildfire. ... Our results show generally long recovery times.”

How State and private forest practices are subverting Oregon’s climate agenda By John Talberth,² Dominick DellaSala,³ and Erik Fernandez⁴

These emissions have averaged between 9.75 and 19.35 million metric tons carbon dioxide equivalent (MMT CO₂-e) per year since 2000 on State and private forestlands in western Oregon. This represents between 16% and 32% of the 60.8 million MMT CO₂-e “in-boundary” emissions estimated for the State by the latest (2012) GHG inventory.

These emissions are four to seven times higher than those associated with coal combustion by the Boardman coal-fired plant in 2012, are equivalent to 2-4 million new cars on the road, and make logging on State and private lands one of Oregon’s biggest GHG polluters and a major impediment to Oregon’s ambitious GHG reduction targets.

Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? John L Campbell^{1*}, Mark E Harmon¹, and Stephen R Mitchell²

“Our review reveals high C losses associated with fuel treatment, only modest differences in the combustive losses associated with high-severity fire and the low-severity fire that fuel treatment is meant to encourage, and a low likelihood that treated forests will be exposed to fire. Although fuel-reduction treatments may be necessary to restore historical functionality

to fire suppressed ecosystems, we found little credible evidence that such efforts have the added benefit of increasing terrestrial C stocks.”

Carbon implications of current and future effects of drought, fire and management on Pacific Northwest forests

B.E. Law [†], R.H. Waring

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Forest fuel reduction alters fire severity and long-term carbon storage. in three Pacific Northwest ecosystems
STEPHEN R. MITCHELL, MARK E. HARMON, AND
KAR, E. B. O'CONNELL Department of Forest Science,
Oregon State University. Corvallis, Oregon 97331 USA

“... C costs associated with fuel treatments have can exceed the magnitude of C reduction in wildfire emissions, because a large percentage of biomass stored in forests (i.e., stem wood, branches, coarse woody debris) remains unconsumed, even in high-severity fires (Campbell et al., 2007; Mitchell et al., 2009)”

Recent Oregon State University Economic study found that subsidies are necessary:
The use of residual forest biomass for rural development faces significant economic hurdles that make it unlikely to be a source of jobs in the near future, according to an analysis by economists at Oregon State University.

... the future feasibility of such development may depend on public investments and the creation of new markets. And while the study considered the possibility of generating biomass from restoration or thinning operations on federal forestlands, it concluded that the additional supply does little to change the economic feasibility of processing facilities.

Assessing Wildfire Risks and Management Effects on Forests of the West Coast
Beverly E. Law
Professor of Global Change Biology & Terrestrial Systems Science Oregon State University

Thinning reduces carbon stocks and sequestration, 100+ years to recoup carbon loss

No guarantees fire will occur during period of thinning effectiveness

High severity fires < 20% of burn area

Social risks: Most ignitions human-caused, near housing and roads -> loss of property

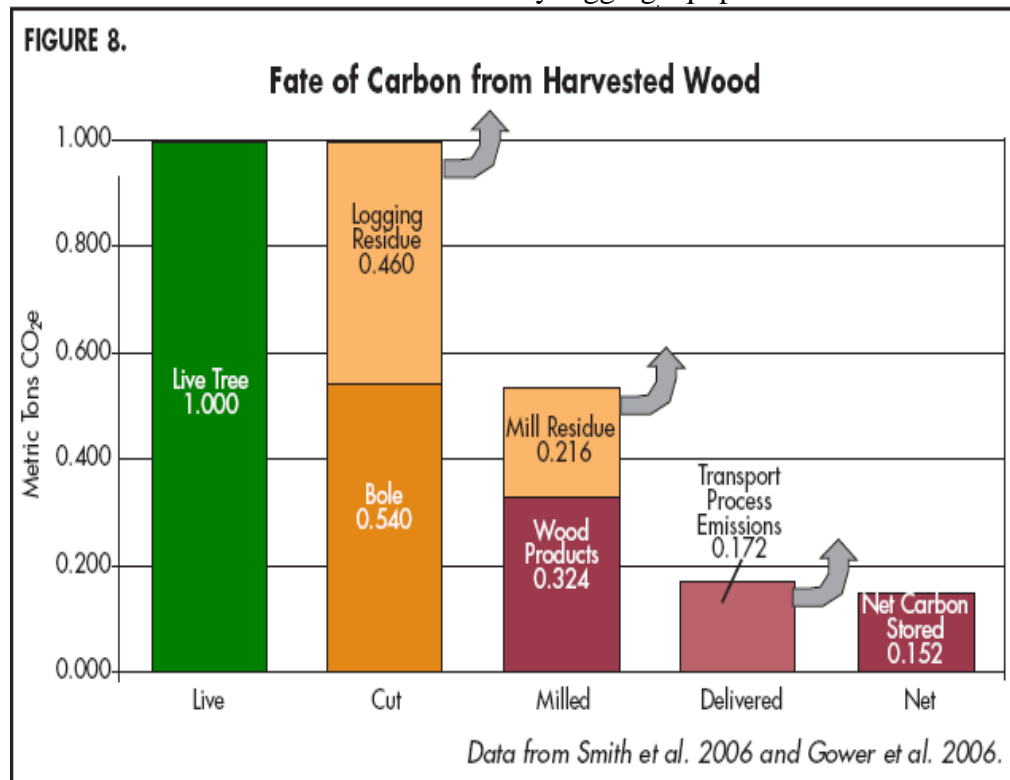
Economic risks: Thinning can be costly in carbon loss and \$\$ compared to fire suppression.

- **WOOD PRODUCTS MYTH:**

It's better to store carbon in wood products, rather than in forests.

Reality: Carbon is stored more securely in long-lived forests than in short-lived wood products.

There is a tremendous loss of carbon at every step of the logging and processing of wood products or biomass. At each step carbon is released. The chart below does not account for the carbon loss from soils disturbed by logging equipment.

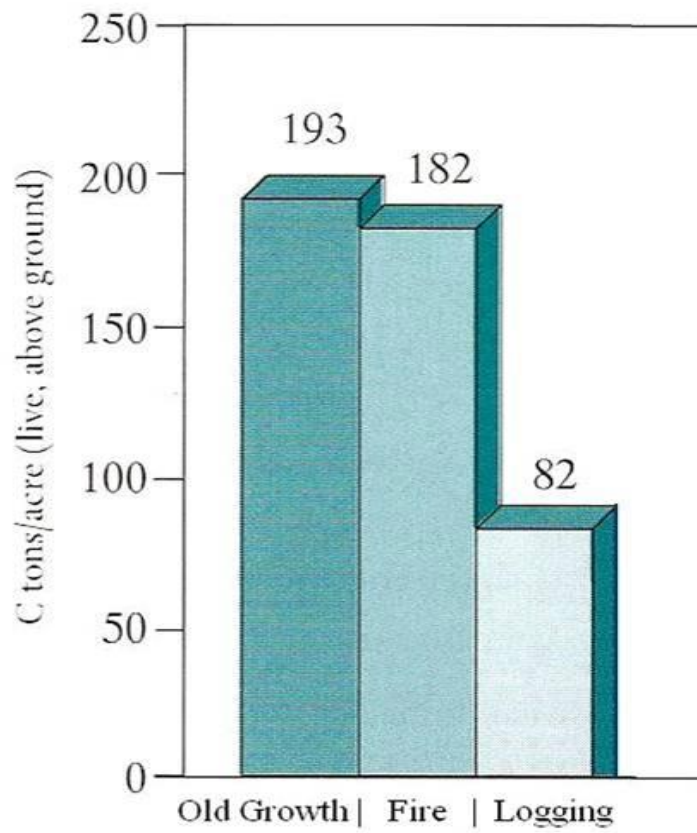


- Carbon loss from wildfire is far less than the losses associated with logging.

Figure 4

EFFECTS OF HARVEST AND FIRE ON FOREST CARBON

Original Store
After Fire
After Harvest



CLIMATE/WEATHER, NOT FUELS, DRIVES LARGE WILDFIRES

One mistaken assumption that underlies thinning programs is that a reduction of fuels will result in a significant decrease in acreage burned, fire-fighting costs, and the amount of high severity fires (notwithstanding the fact that high severity blazes and the dead snags and down wood they produce are necessary for healthy forest ecosystems).

The clear majority of all acreage (burned annually is the result of a few wildfires. These large high-severity wildfires burn under “extreme” fire weather conditions of high temperatures, low humidity, drought, and high winds. Without those ingredients fires remain small and easily controlled.

For instance, a total of 56,320 fires burned over 9 million acres in the Rocky Mountains between 1980-2003. 98% of these fires (55,220) burned less than 500 acres and accounted for 4% of the area burned. By contrast, Only, 2% of all fires accounted for 96% the acreage burned. And 0.1% (50) of blazes were responsible for half of the acres charred. (Baker 2009 Fire Ecology in Rocky Mountain Landscapes).

Thus, the wildfires thinning operations are seeking to modify are those burning under extreme fire weather conditions. These are fires which thinning fuel reductions are unlikely to significantly influence.

Furthermore, the probability of a wildfire encountering a fuel reduction is very small, even if they did work as some suggest, making most fuel reductions essentially useless, but still leaving behind the negative impacts of logging on soils, watersheds, nutrients, carbon storage, wildlife habitat losses, and consequences like spread of weeds, sedimentation from roads into streams and so on.

Plus there is evidence that timber management (i.e. logging) can actually increase fire severity.

HOW EFFECTIVE IS THINNING FORESTS AT REDUCING LARGE HIGH SEVERITY FIRES?

Wildfire Cast Management

“Finally, by current standards, even our best fuel reduction do not appear to be adequate to provide much assistance in the control of high intensity wind-driven fires. If fuel treatment is the answer, it will need to be done on a level that is far more extensive (area) and intensive (fuel reduction than we are now accomplishing—even on our best fuel breaks.”

Gedalof, Z., D. L. Peterson, and N. J. Mantua. 2005. Atmospheric, climatic, and ecological controls on v www.esajournals.org 21 November 2012 v Volume 3(11) v Article 103 HOLZ ET AL. extreme wildfire years in the northwestern United States. Ecological Applications 15:154–174

“fuel treatments ...cannot realistically be expected to eliminate large area burned in severe fire weather years.”

Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States

“Extreme environmental conditions . . .overwhelmed most fuel treatment effects. . . This included almost all treatment methods including prescribed burning and thinning. . . .Suppression efforts had little benefit from fuel modifications.”

University of California; SNEP Science Team and Special Consultants
“*Sierra Nevada Ecosystem Project: Final Report to Congress*

“*Timber harvest, through its effects on forest structure, local microclimate, and fuels accumulation, has increased fire severity more than any other recent human activity.*”(pg.62)

The Congressional Research Service (CRS) :

“*From a quantitative perspective, the CRS study indicates a very weak relationship between acres logged and the extent and severity of forest fires. ... the data indicate that fewer acres burned in areas where logging activity was limited.*”

Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western United States?

Curtis M. Bradley, Chad T. Hanson, Dominick A. DellaSala

“We investigated the relationship between protected status and fire severity applied to 1500 fires affecting 9.5 million hectares between 1984 and 2014 in pine (*Pinus ponderosa*, *Pinus jeffreyi*) and mixed-conifer forests of western United States... We found forests with higher levels of protection had lower severity values even though they are generally identified as having the highest overall levels of biomass and fuel.”

Fuel Treatment Effectiveness in the United States
Mark A. Cochrane et al.

“The net effect of all treatments for the 56 wildfires with statistically significant changes in treatment-related fire extents averaged a 7% reduction in burned area.... In wildfires that had significantly reduced burned area, the average decrease in size was 25%, while wildfires that were significantly increased expanded by an average of 28%.”

FIRE WEATHER . . . A Guide For Application Of
Meteorological Information To Forest Fire Control
Operations,

“dense timber stands shades the ground and the forest fuels from elevated temperatures from solar radiation. The forest canopy radiates out the heat accumulated from solar radiation. The forest canopy provides moisture by transpiration through the leaves to the air and forest fuels, which decreases the possibility of forest fires. Transpiration from an area of dense vegetation can contribute up to eight times as much moisture to the atmosphere as can an equal area of bare ground. The forest canopy slows down wind movement and fire progress, due to its large friction area. A forest with a dense understory is an effective barrier to down slope winds.”

recently treated forests can experience a stand-replacing crown fire when wind speeds exceed 30 km h⁻¹ and when

Fire Probability, Fuel Treatment Effectiveness and
Ecological Tradeoffs in Western U.S. Public Forests
Jonathan J. Rhodes¹ and William L. Baker*,

“When the probability of fire occurring in a particular area is relatively low, the odds of a fuel treatment influencing the behaviour of a wildfire there, within the time frame that treatments are effective, is also low.”

Beyond Fuel Treatment Effectiveness: Characterizing Interactions between Fire and Treatments in the US Kevin Barnett ^{1,*}, Sean A. Parks ², Carol Miller ² and Helen T. Naughton ¹

“Myriad economic and operational constraints to fuel treatment implementation on federal lands in the United States make it unlikely that treatments alone can achieve forest restoration goals at landscape scales [16] suppressing wildland fire within a matrix of previously treated areas, especially during moderate weather conditions, forgoes a low-risk opportunity to capture the fuel treatment benefits provided and maintained by wildland fire. “

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“Wildfire occurrence in a given area is uncertain and may never interact with treated stands with reduced fire hazard, ostensibly negating expected C benefits from fuel treatments. Burn probabilities in treated stands in southern

Oregon are less than 2%, so the probability that a treated stand encounters wildfire and creates C benefits is low.”

Wildfire and fuel treatment effects on forest carbon dynamics in the western United States ()
CrossMark Joseph C. Restaino a.*. David L. Peterson b

Studies at large spatial and temporal scales suggest that there is a low likelihood of high-severity wildfire events interacting with treated forests negating any expected C benefit from fuels reduction.

Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States

“The majority of acreage burned by wildfire in the US occurs in a very few wildfires under extreme conditions (Strauss et al., 1989; Brookings Institution, 2005). Under these extreme conditions suppression efforts are largely ineffective.”

“Wildland fuel reduction may be inefficient and ineffective for reducing home losses, for extensive wildland fuel reduction on public lands does not effectively reduce home ignitability on private lands.” *Jack Cohen Missoula Fire Lab Specialist*

Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States

“...it is the treatment of the fuels immediately proximate to the residences, and the degree to which the residential structures themselves can ignite that determine if the residences are vulnerable.”

FIRE SUPPRESSION OR CLIMATE?

We hear all the time that “fire suppression” has created abnormal fuel loads. However, climate plays a large role in fire ignitions and fire spread. During the period when fire suppression was “effective” the climate was not conducive to fire spread.

If you don’t have the right conditions for large fires—namely extended drought, high temperatures, low humidity, and high winds, you will not get large fires. So climate/weather is the driver of large fires that burn significant acreage.

Furthermore, cool, moist weather contributes to higher seedling establishment, hence denser forests. As a result, much of the so-called “unhealthy forests” are a natural and normal consequence of climate. As the climate has dried, and drought become more extreme we are now experiencing larger wildfires—again another natural consequence of climate/weather.

The following graph of the acreage burned annually and the influence of the Pacific Decadal Oscillation which influences the off-shore ocean currents, which in turn, influences climate over

decades. The graph shows that between the late 1930s and 1980s, was moister and cooler than prior decades or more recent decades.

Area burned in 11 Western states, 1916-2007

